Illicit Discharge Detection and Elimination (IDDE) 101:

Program Development

U.S. EPA Stormwater Program's Webcast Series
September 12, 2006

Jennifer Zielinski
Center for Watershed Protection

Darrin Peine
City of Charlotte, North Carolina

Nikos Singelis
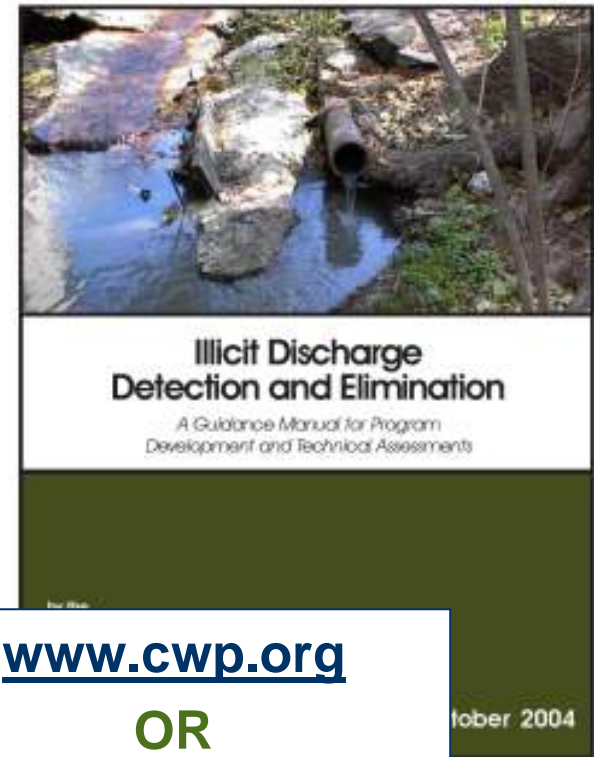U.S. EPA Stormwater Program

Presentation Overview

- IDDE Manual Overview
- Terminology Review
- Phase I Survey Findings
- Implications for Phase II Communities
- Essential Components of a Local IDDE Program
- IDDE Case Study – City of Charlotte, NC

IDDE Guidance Manual

- Joint EPA-funded project between CWP and University of Alabama
- 8 Program Elements
- Desktop Methods
- Field and Lab Protocols
- Model Ordinance
- Technical Appendices

Illicit Discharge Detection and Elimination

A Guidance Manual for Program Development and Technical Assessments

October 2004

www.cwp.org
OR
www.epa.gov/npdes

What is an Illicit Discharge?

- A discharge to an MS4 that is not composed entirely of storm water except permitted discharges and fire fighting related discharges

  40 CFR 122.26(b)(2)

  - Unique frequency, composition & mode of entry
  - Interaction of the sewage disposal system & the storm drain system
  - Produced from "generating sites"

What is a Storm Sewer?

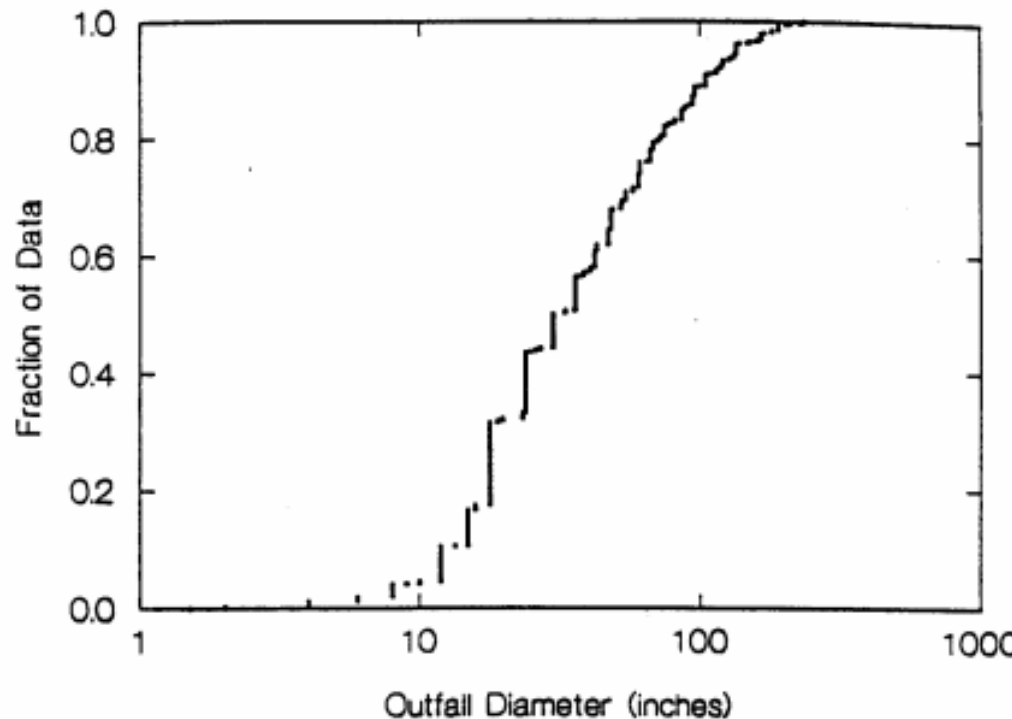*A municipal separate storm sewer system (MS4) is…*

A conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the U.S. and is:

designed or used for collecting or conveying stormwater

not a combined sewer

not part of a Publicly Owned Treatment Works (POTW)

EPA Recommends That You Inventory ALL Outfalls

Small outfalls (<36") represent 50% of outfalls in Birmingham, AL

6" Drain in Lewisburg, Tennessee

Discharge Frequency

- **Continuous discharges**
  - Occur *most or all of the time*

- **Intermittent discharges**
  - Occur over a *shorter period of time* (e.g., a few hours per day or a few days per year)

- **Transitory discharges**
  - *Occur rarely*, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode

Discharge Flow Types

- Sewage & septage flows
- Washwater flows
- Liquid wastes
- Tap water *
- Landscape irrigation flows *
- Groundwater & spring water flows *

* Not typically considered illicit

Mode of Entry

- ***Direct entry***
  - Sewage, industrial, commercial cross-connection
  - Straight pipe

  - ***Indirect entry***
    - Groundwater seepage
    - Spills
    - Dumping
    - Outdoor washing activities
    - "Nuisance" or non-target water

Land Use & Potential Generating Sites

- Residential
- Commercial
- Industrial
- Institutional
- Municipal

Phase II Program Requirements
(Source: 64 FR 68722 – December 8, 1999)

- Storm sewer system map
- Regulatory mechanism (e.g. ordinance) to prevent illicit discharges
- Plan to detect & address non-storm water discharges
- Education
- Measurable goals

Wednesday
December 8, 1999

Part II

Environmental
Protection Agency

40 CFR Parts 9, 122, 123, and 124
National Pollutant Discharge Elimination
System—Regulations for Revision of the
Water Pollution Control Program
Addressing Storm Water Discharges;
Final Rule
Report to Congress on the Phase II
Storm Water Regulations; Notice

federal register

Design of Phase I Program Survey

Illicit Discharge Detection and Elimination
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October 2004

- Community Characterization
- System Characterization
- IDDE Program Characterization & Cost
- Legal Authority
- System Mapping
- Methods to Identify & Confirm Inappropriate Discharges
- Inappropriate Discharge Corrections Program
- Education, Outreach, & Pollution Prevention Programs
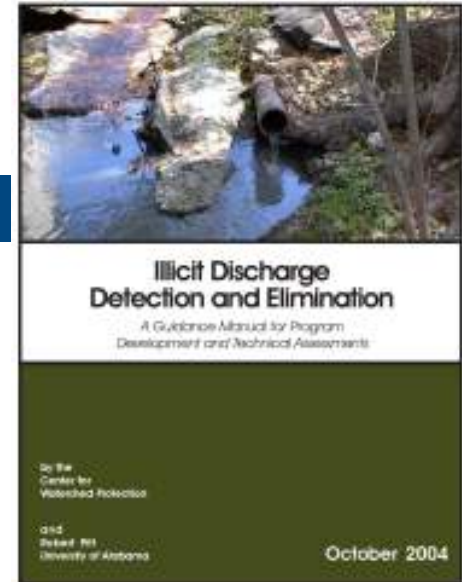
Jurisdiction Characterization

	Median	Minimum	Maximum
Population Density (people/mi^2)	2,641	175	15,000
Service Area (mi^2)	70	2	498
Total Length of Storm Drainage Network (mi)	582	81	3,500
# of Major Outfalls	250	6	7,165
Outfall / Mile of Drainage Network	0.33	0.01	3.1

The Value of Field Staff

- Typically, **67%** of program staff time is dedicated to **field work**

- Experienced field staff are a **valuable asset**

- **Lack of staff expertise** & experience is a **top problem** in identifying inappropriate discharges

Dedicated staff time ranged from 0.08 - 10 person-yrs, with a median of 1.5 person-yrs

Common Legal Authority Approaches

- **Stormwater Ordinance**
  - addresses inappropriate discharges to the storm sewer system or receiving waters
- **Plumbing Code**
  - addresses illegal connections to the storm sewer system
- **Health Code**
  - regulates the discharge of harmful substances to the storm sewer system or receiving waters

Common IDDE Program Mapping Elements

- Storm sewers (96%)
- Waters of the US receiving discharges from outfalls (83%)
- Outfalls (79%)
- Open channels (71%)
- Land use (67%)
- Sanitary sewers (63%)
- Industrial discharge permit holders (33%)

- Building connections to storm sewers (25%)
- Connections to adjacent systems (25%)
- Building connections to sanitary sewers (21%)
- Watershed, outfall drainage area boundaries (13%)
- Hotspot areas (13%)

Investigative Methods

- Most of the jurisdictions use **several** different methods
- Initial **outfall screening** successful at identifying **chronic problems**
- For **sporadic discharges**, jurisdictions are relying heavily on **hotlines** and **cross-training of staff**
- **Special studies**, **in-stream monitoring** and **targeted problem area screening** supplement efforts

Outfall Monitoring

- Most IDDE programs conduct major outfall monitoring on a "regular basis":
  - Screen each major outfall at least once over the NPDES Phase I permit cycle (5 years)
  - Screen each major outfall at least once a year
  - Screen major outfalls in the MS4 on a staggered schedule, based on contributing land use & history of chronic problems

Most Common Approach to Outfall Screening

- **Visual inspection** of the outfall
- **Qualitative** assessment of any flow present, including examination of water color, odor, turbidity, floatables, & sedimentation
- Follow-up grab sample for **quantitative** analysis, either using more sophisticated field equipment or a laboratory

Many jurisdictions bypass the quantitative tests and immediately go "***up the trunk***" to find the source of the discharge

Sources of Illicit Discharges

- Illegal dumping practices (95%)
- Broken sanitary sewer line (81%)
- Cross-connections (71%)
- Connection of floor drains to storm sewer (62%)
- Sanitary sewer overflows (52%)
- Inflow / infiltration (48%)
- Straight pipe sewer discharge (38%)
- Failing septic systems (33%)
- Improper RV waste disposal (33%)
- Pump station failure (14%)

Problems in Finding Illicit Discharges

Source Related
- Periodic nature
- Illegal dumping / one-time dischargers
- Illegal connections
- I/I from sanitary sewers
- After-hours discharges

Infrastructure Related
- Access (building, stream, outfall, traffic)
- Complexity, size of storm drain network
- Tides and groundwater
- Blended flow types
- Multiple sources w/in system

Program Related
- Map accuracy
- Timeliness of complaint
- Insufficient staff
- Lack of expertise
- Slow laboratory analysis
- Unreliable equipment
- Unreliable indicators

Source: Ft. Worth DEM

IDDE Education Target Audiences

- Resident Education (100%)
  - Storm drain stenciling, outfall signage, hotline promotion
- Schoolchildren
  - School presentations
- Commercial (95%) / Industrial (79%)
  - Targeted at "hotspot" activity
- Public Employees (63%)
  - Field crew & inspector cross-training

Source: NVRC (Four Mile Run)

Primary Conclusions

- Experienced field staff is a valuable asset.
- Budgets drive methods used to identify potential inappropriate discharges.
- Effective and comprehensive legal authority is critical.
- A good program starts with good mapping.
- Much of the field equipment is commonly available in various municipal departments.

What this means for Phase II

- Staffing and training
- Ordinance language
- Mapping of storm sewers, open drainage channels, waters of the US, outfalls, and land use
- Outfall screening
- Cross-training and communication
- Accurate, cost effective, and safe methodologies
- Hotlines and other education/outreach efforts

Questions?

IDDE Guidance Manual
8 Program Components

1. Audit Existing Resources & Programs
2. Establish Responsibility & Authority
3. Complete Desktop Assessment of Illicit Discharge Potential
4. Develop Program Goals & Strategies
5. Search for Illicit Discharge Problems in the Field
6. Isolate & Fix Individual Discharges
7. Prevent Illicit Discharges
8. Evaluate the Program

Illicit Discharge Detection and Elimination

A Guidance Manual for Program Development and Technical Assessments

by the
Center for
Watershed Protection

and
Robert Pitt
University of Alabama

October 2004
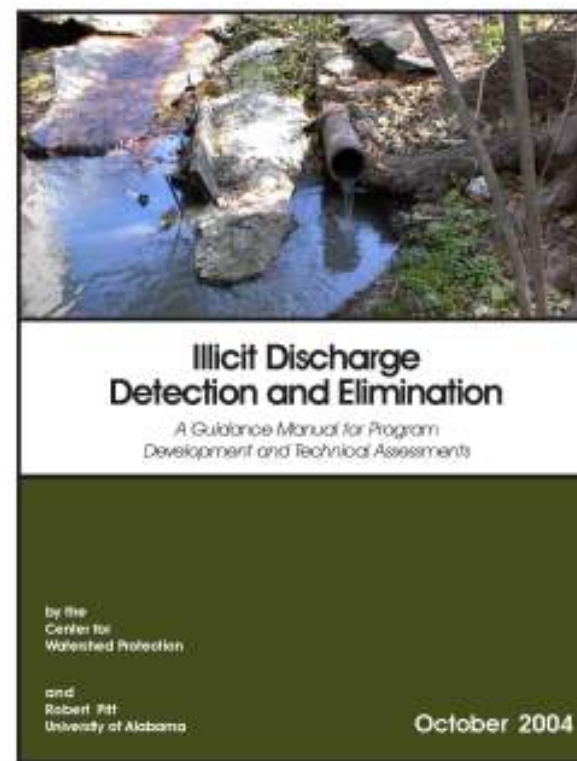
Audit Existing Resources & Programs

Purpose:

- Determine the most capable local agency to run program

- Identify available staffing, resources and gaps

- Understand local resources, expertise that can be applied

Desired Outcome:

- Initial five year IDDE program development plan over the current permit cycle

Audit Elements

- Infrastructure profile
- Legal authority
- Available mapping
- Field staff
- Access to lab services

- Education & outreach resources
- Discharge removal capability
- Program budget & financing

Potential Infrastructure Profile Questions:
How many miles of streams and storm drains exist in the MS4?
What is the area served by storm drains, sewers, and septics?
What is the general age and condition of the infrastructure?

Establish Responsibility & Authority

Purpose:

- Establish authority to regulate, respond to & enforce discharges
- Prohibit inappropriate connections
- Develop reporting & tracking system

Desired Outcome:

- Local ordinance
- Internal & external reporting & tracking system

Illicit Discharge Ordinances

- Prohibit illicit discharges & illegal connections
- Provide for access & inspection
- Require & enforce elimination
- Address unique conditions or requirements

Complete Desktop Assessment of Illicit Discharge Potential

Purpose:

- Determine the potential severity for illicit discharges
- Identify which subwatersheds or generating land uses merit priority investigation

Desired Outcome:

- Screening of problem subwatersheds
- Outfall tracking system
- Assessment of severity of illicit discharge problems
- Basic mapping

Screening Factors

- Past Discharge Complaints
- Poor Dry Weather Water Quality
- Density of Generating Sites
- Density of Industrial NPDES Permits
- Stormwater Outfall Density

- Age of Subwatershed Development
- Former Combined Sewers
- Older Industrial Operations
- Aging or Failing Sewers
- Density of Older Septic Systems
- Past Sewer Conversions

Select the factors that apply most to your community

Prioritizing Subwatersheds Using IDP Screening Factors

Subwatershed	Past discharge complaints	Poor dry weather WQ	Density of SW outfalls	Average age of dev.	Raw IDP score	Normalized IDP score
Subwatershed A	8 **(2)**	30% **(2)**	14 **(2)**	40 **(2)**	**8**	**2**
Subwatershed B	3 **(1)**	15% **(1)**	10 **(2)**	10 **(1)**	**5**	**1.25**
Subwatershed C	13 **(3)**	60% **(3)**	16 **(2)**	75 **(3)**	**11**	**2.75**
Subwatershed D	1 **(1)**	25% **(1)**	9 **(1)**	15 **(2)**	**5**	**1.25**
Subwatershed E	5 **(1)**	15% **(1)**	21 **(3)**	20 **(1)**	**6**	**1.5**

Basis for Assigning Scores…	**1**	**2**	**3**
Past discharge complaints/reports (total # logged)	< 5	5 - 10	> 10
Dry weather water quality (# times bacteria stds exceeded)	< 25%	25 - 50%	> 50%
Storm water outfall density (# outfalls / stream mile)	< 10	10 - 20	20
Average age of development (years)	< 25	25 - 50	> 50

Communities with…

Minimal Illicit Discharge Problems

Severe Illicit Discharge Problems
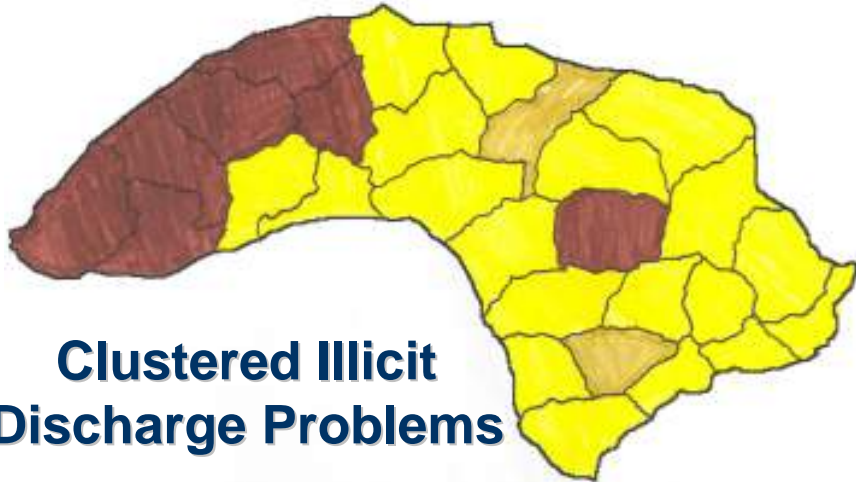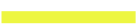
Clustered Illicit Discharge Problems
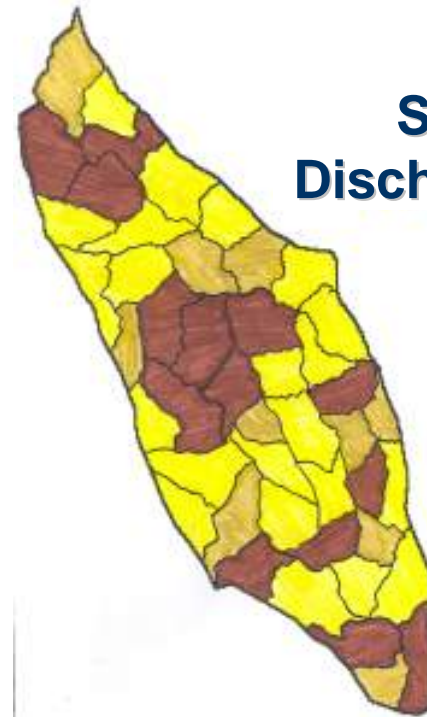
Key:

Low IDP risk

Medium IDP risk

High IDP risk

Develop Program Goals & Strategies

Purpose:

- Define milestones to measure progress during 1st permit cycle
- Ensure resources allocated to address real problems
- Choose most appropriate & cost-effective methods to find discharges

Desired Outcome:

- Program goals, measurable indicators & implementation strategies for:
  - Overall program administration
  - Outfall assessment
  - Finding and fixing illicit discharges
  - Prevention of illicit discharges

Conditions Driving Program Setup

- **No Suspected Discharges**
  - broader stream assessment program

- **Isolated or Clustered Problems**
  - confined subwatersheds, reaches, or specific industries where history of suspect discharges exist

- **Severe Problems**
  - recognize that IDDE program will need significant commitment (staff, equipment, budget) for improvements to be realized

Refining Strategies to Address Unique Conditions… Aging Septic Infrastructure

- Develop targeted education program for septic system maintenance

- Institute a point of sale inspection and verification process

- Develop cost share capabilities to assist property owners with upgrade of system

For more information:
Decentralized Wastewater Treatment Systems: A Program Strategy
www.epa.gov/owm/septic/pubs/septic_program_strategy.pdf

Questions?

Search for Illicit Discharge Problems in the Field

Purpose:

- Conduct rapid field screening of all outfalls in priority subwatersheds
- Conduct indicator monitoring at suspect outfalls to characterize flow types & trace sources

Desired Outcome:

- Locations & characterizations of all outfalls
- Design & implementation of indicator monitoring strategy
- Local "fingerprint" library

IDDE Monitoring Framework
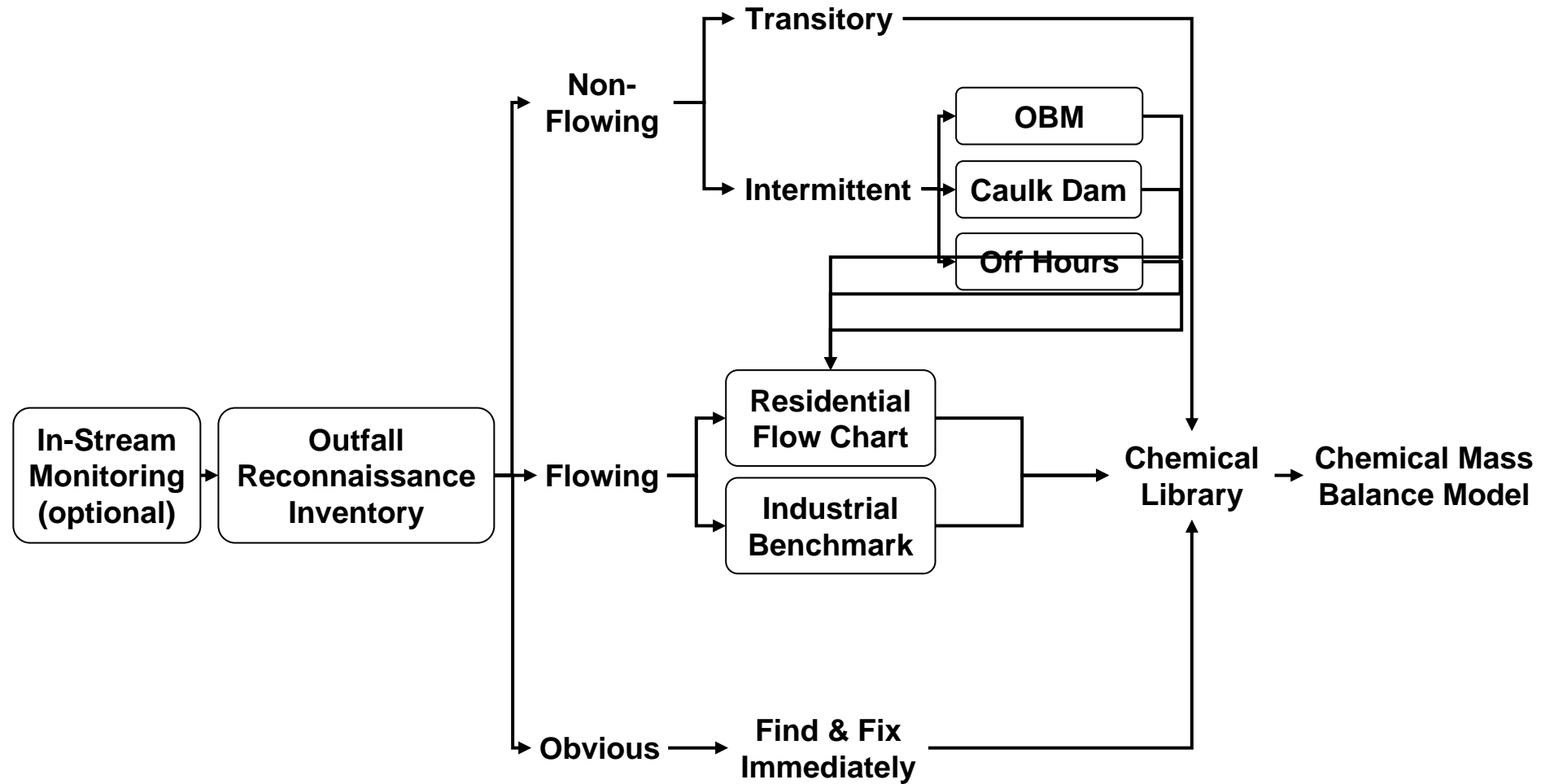
Denotes a monitoring methods

Outfall Reconnaissance Inventory (ORI)

- Map, mark & photograph outfalls

- Record basic characteristics

- Look for physical indicators

- Conduct simple monitoring at flowing outfalls

Photo Source: R. Frymire

OUTFALL RECONNAISSANCE INVESTIGATION FIELD SHEET

SECTION 4. PHYSICAL INDICATORS FOR FLOWING OUTFALLS ONLY

ARE ANY PHYSICAL INDICATORS PRESENT IN THE FLOW? ☐ YES   ☐ No   (*IF No, SKIP TO SECTION 5*)

INDICATOR	CHECK IF PRESENT	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
ODOR	☐	☐ SEWAGE ☐ RANCID/SOUR ☐ PETROLEUM/GAS ☐ SULFIDE ☐ OTHER: _____	☐ 1 – Faint	☐ 2 – Easily detected	☐ 3 – Noticeable from a distance
COLOR	☐	☐ CLEAR ☐ BROWN ☐ GREY ☐ YELLOW ☐ GREEN ☐ ORANGE ☐ RED ☐ OTHER: _____	☐ 1 – Faint colors in sample bottle	☐ 2 – Clearly visible in sample bottle	☐ 3 – Clearly visible in outfall flow
TURBIDITY	☐	SEE SEVERITY	☐ 1 – Slight cloudiness	☐ 2 – Cloudy	☐ 3 – Opaque
FLOATABLES -DOES NOT INCLUDE TRASH!!	☐	☐ SEWAGE (TOILET PAPER, ETC.) ☐ PETROLEUM (OIL SHEEN) ☐ OTHER: _____	☐ 1 – Few/slight; origin not obvious	☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen)	☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

SECTION 5. PHYSICAL INDICATORS FOR BOTH FLOWING AND NON-FLOWING OUTFALLS

ARE PHYSICAL INDICATORS NOT RELATED TO FLOW PRESENT? ☐ YES ☐ No   (*IF No, SKIP TO SECTION 6*)

INDICATOR	CHECK IF PRESENT	DESCRIPTION	COMMENTS
OUTFALL DAMAGE	☐	☐ SPALLING, CRACKING OR CHIPPING ☐ PEELING PAINT ☐ CORROSION	
DEPOSITS/STAINS	☐	☐ OILY ☐ FLOW LINE ☐ PAINT ☐ OTHER: _____	
ABNORMAL VEGETATION	☐	☐ EXCESSIVE ☐ INHIBITED	
POOR POOL QUALITY	☐	☐ ODORS ☐ COLORS ☐ FLOATABLES ☐ OIL SHEEN ☐ SUDS ☐ EXCESSIVE ALGAE ☐ OTHER: _____	
PIPE BENTHIC GROWTH	☐	☐ BROWN ☐ ORANGE ☐ GREEN ☐ OTHER: _____	

## SECTION 6. OVERALL OUTFALL CHARACTERIZATION

☐ No indication of illicit discharges   ☐ Some likelihood of illicit discharge (i.e., presence of 2 or more indicators)   ☐ Almost certain a discharge exists (i.e., 1 or more indicator with a severity of 3)

SECTION 7. DATA COLLECTION

1. SAMPLE FOR THE LAB?   ☐ YES   ☐ No
2. IF YES, COLLECTED FROM: ☐ FLOW   ☐ POOL
3. OBM TRAP SET?   ☐ YES   ☐ No

SECTION 8. ANY NON-ILLICIT DISCHARGE CONCERNS (E.G., TRASH OR NEEDED INFRASTRUCTURE REPAIRS)?

Flow Chart to Identify Illicit Discharges in Residential Drainage Areas
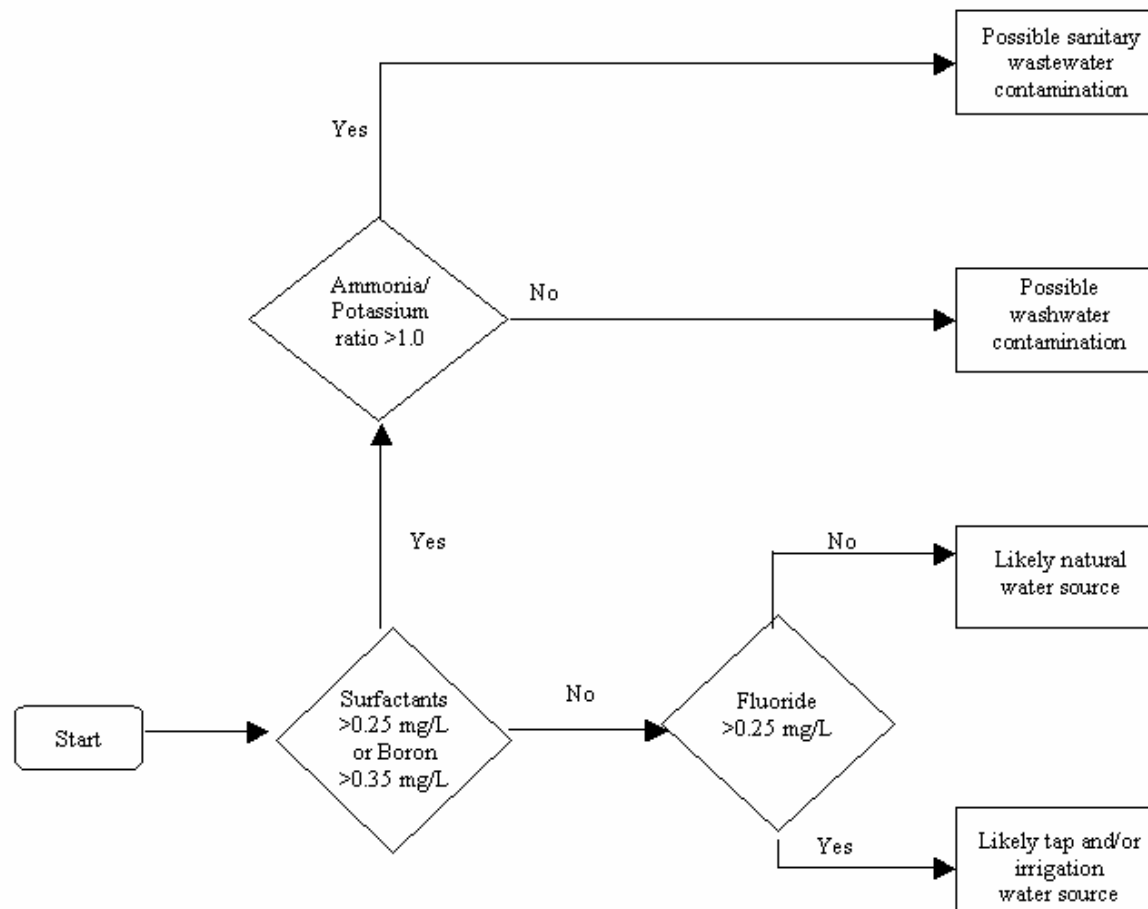
Benchmark Concentrations to Identify Industrial Discharges

Benchmark	Concentration	Notes
Ammonia (mg/L)	≥ 50	• Existing "Flow Chart" Parameter • Concentrations higher than the benchmark can identify a few industrial discharges
Potassium (mg/L)	≥ 20	• Existing "Flow Chart" Parameter • Excellent indicator of a broad range of industrial discharges
Color (Units)	≥ 500	• Supplemental parameter that identifies a few specific industrial discharges
Conductivity (μS/cm)	$\geq 2{,}000$	• Identifies a few industrial discharges • May be useful to distinguish between industrial sources
Hardness (mg/L as $CaCO_3$)	≤ 10 $\geq 2{,}000$	• Identifies a few industrial discharges • May be useful to distinguish between industrial sources
pH (Units)	≤ 5	• Only captures a few industrial discharges • High pH values may also indicate an industrial discharge but residential wash waters can have a high pH as well
Turbidity (NTU)	$\geq 1{,}000$	• Supplemental parameter that identifies a few specific industrial discharges

Special Indicators for Intermittent Discharges

- Optical brightener monitoring
- Toxicity testing
- Outfall damming
- Take a sample from the pool

Isolate & Fix Illicit Discharges

Purpose

● Use a variety of tools & techniques to narrow down the source of illicit discharges & correct the problem

● Establish an appropriate & effective enforcement program to ensure repair

Desired Outcome:

● Finding & fixing illicit discharges is the core goal

● Ancillary outcomes:

– Reduced incidences of illicit discharges = improved water quality

– Increased homeowner & business awareness

– Tracking system to document problems & repairs & identify repeat offenders

Discharge Complaint Hotline

- Leads to early detection & correction
- Encourages active public stewardship
- Can "piggyback" on other call response needs
- Identifies suspected facilities for further investigation & education
- Increases municipal accountability

- Good tool to pick up intermittent and transitory discharges
- Time & money to provide 24/7 service
- Marketing the hotline number
- Establishing inter- & intra-departmental response process

Rapid Drainage Area Investigation

Source: R. Frymire

Finding and Fixing

- Move up the pipe
- Use smoke or dye testing once narrowed
- Use enforcement or repair

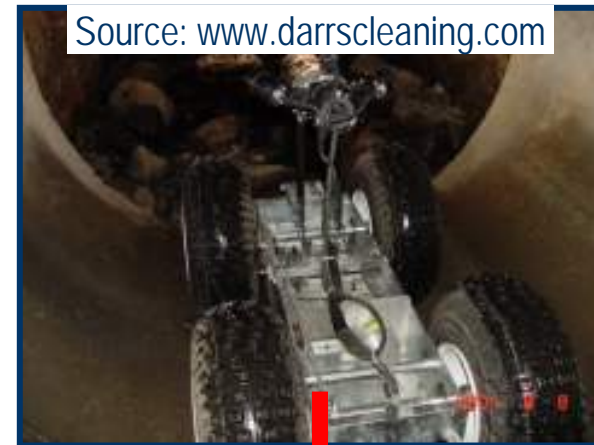# Techniques to Locate the Discharge

Source: www.darrscleaning.com

Source: NEIWPPC,2003

Source: www.darrscleaning.com

Source: www.darrscleaning.com

Source: www.darrscleaning.com

Fixing Illicit Discharges

- Who is responsible?
- What methods will be used to repair?
- How long will the repair take?
- How will removal be confirmed?

Prevent Illicit Discharges

Purpose:

- Identify location & regulatory status of generating sites
- Screen for bad actors
- Target appropriate education & enforcement efforts

Desired Outcome:

- Local prevention programs targeting common intermittent and transitory discharges
- Target: neighborhoods, generating sites, and municipal housekeeping

IDDE Education Target Audiences

- Resident Education
  - Storm drain stenciling, outfall signage, hotline promotion, school presentations
- Commercial and Industrial Hotspots
- Public Employees
  - Field crew & inspector cross-training

Source: City of Phoenix, AZ

Hotspot Site Investigation

- Vehicle Operations
- Outdoor Material
- Waste Management
- Physical Plant
- Turf / Landscaping Areas
- Unique Operations

For more information:
Unified Subwatershed and Site Reconnaissance: A User's Manual
www.cwp.org

Evaluate the Program

Purpose:

- Review progress made in meeting measurable program goals

- Revise program as necessary to ensure elimination of illicit discharges in most cost-effective way

Desired Outcome:

- Updated tracking database

- Annual report with summary of progress to date, findings, recommendations for program revisions, & work plan for upcoming year

Fundamental units to track are individual outfalls…

- Geospatial coordinates
- Subwatershed & watershed address
- Contributing land use
- Diameter & physical characteristics
- Field assessment data
- Digital photos
- Follow-up monitoring at outfall or further up pipe
- Hotline complaints, along with response
- Status & disposition of enforcement actions
- Maintenance & inspection data

Program Tracking Systems

- Updated mapping to reflect locations of illicit discharges and problems
- Water quality results associated with specific outfall and in-stream sampling
- Frequency of hotline use
- Number of "hits" or confirmed illicit discharges
- Program costs by line item
- Number of corrections and associated cost

IDDE Program Costs

IDDE Program Component		Start Up Cost	Annual Cost
1: Audit	Perform Audit	$3K - $9K	--
	Initial Program Plan	$1K - $3K	--
2: Authority	Adopt Ordinance	$1K - $17K	--
	Tracking System	$2K - $15K	$2K
3: Desktop Assessment	Desktop Analysis	$1K - $4K	--
	Field Mapping	$500 - $1K	--
4: Goals & Strategies	Develop Goals	$1K - $3K	--
	Field Monitoring Strategy	$1K - $3K	--
5: Search for Discharges	ORI	--	$5.7K - $12.8K
	Establish Hotline	$1.3K - $7.7K	$1.5K - $11.4K
	Sample Analysis	$500 - $15.5K	$9K - $21.2K
	Outfall Map	--	$500 - $1K
6: Isolate & Fix Discharges	Isolate	--	$2K - $5.2K
	Fix	--	$10K - $30K
7: Prevent Discharges	Education	$1K - $8.1K	$1.3K - $13.9K
	Enforcement	--	$1K - $14K
8: Evaluate Program	Program Administration	$10K - $15K	$10K - $15K
TOTAL		**$23,300 - $101,300**	**$43,000 - $126,500**

Top 15 Tips for Effective IDDE Programs

1. Go after *continuous sewage discharges* first
2. Put together an *interdisciplinary and interagency* IDDE development team
3. Educate *everybody* about illicit discharges
4. Understand your *infrastructure*
5. Walk *all of your streams* in the first permit cycle

Top 15 Tips for Effective IDDE Programs

6. Use GPS to create your *outfall map*

7. Don't develop a monitoring plan until you *understand your discharges*

8. Utilize a *simple outfall tracking system* to organize your data

9. Outsource some functions to *local watershed groups*

10. Utilize a *hotline* as an education and detection tool

Top 15 Tips for Effective IDDE Programs

11. *Cross-train* all local inspectors

12. *Target* your precious storm water education dollars

13. Stress *public health and safety benefits* of sewage-free streams

14. Calibrate your program resources to the *magnitude of your problem*

15. Think of discharge prevention as a *tool of watershed restoration*

Questions?

CHARLOTTE-MECKLENBURG
Illicit Discharge Program
Presented by Darrin Peine – City of Charlotte, NC

Marshal Park

Presentation Outline

- **Introduction to Charlotte's IDDE Program and Examples of Illicit Discharges Found in Charlotte Since the Program Began**
- **IDDE Detection Methods used in Charlotte**
  - **Public Awareness**
  - **Stream Monitoring**
  - **Stream Walking**
  - **Industrial Inspections**
 - **Infrared Aerial Photography**
    - **Charlotte-Mecklenburg IDDE Elimination Methods**

http://stormwater.charmeck.org

Introduction to Charlotte-Mecklenburg's Illicit Discharge Program

- Program began in 1995, Staff Implemented

- Originally Funded through Local Tax Dollars, Currently Funded through Stormwater Utility Fees

- Budget of Approx. $600,000 annually
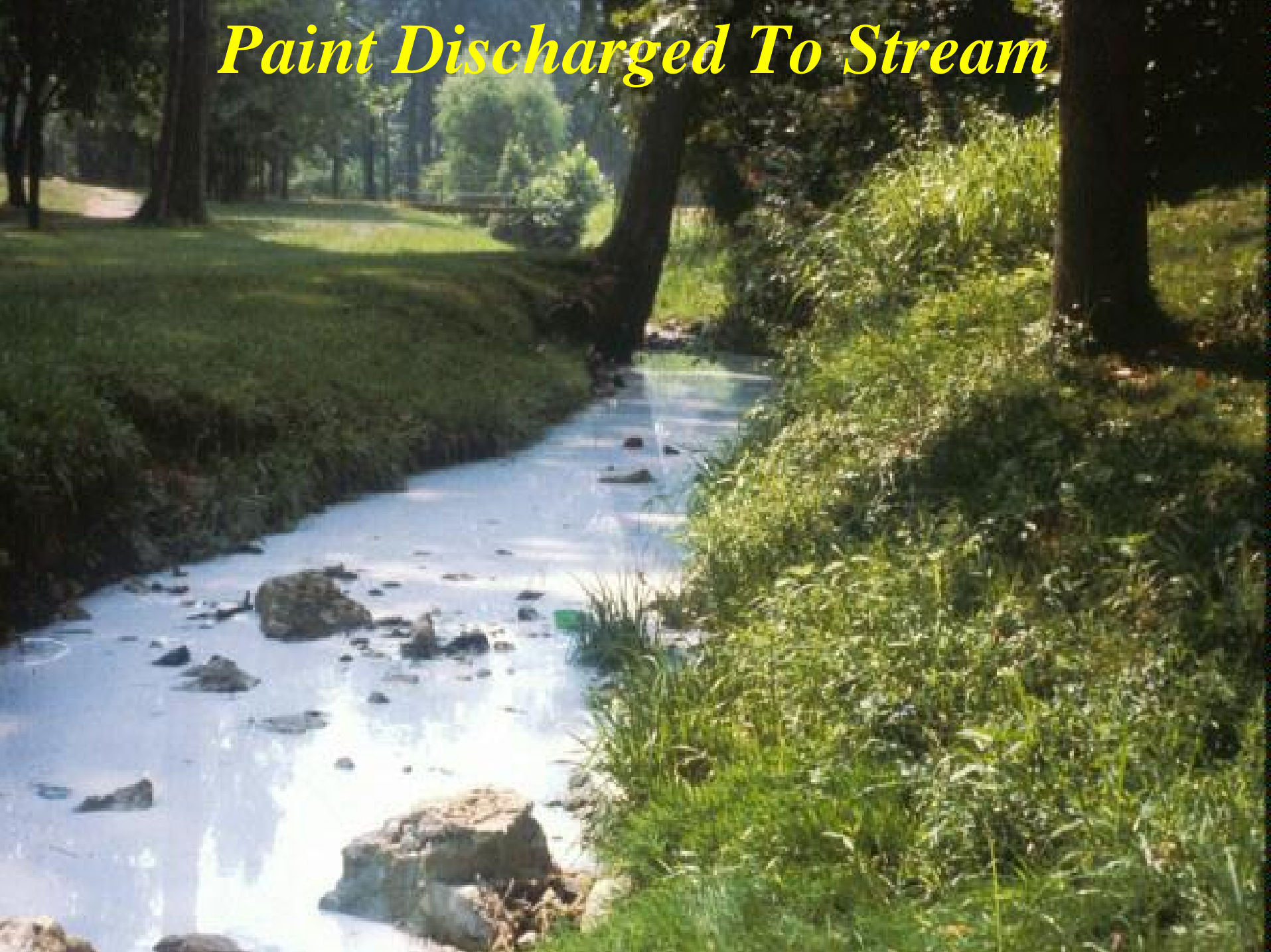- Charlotte-Mecklenburg 2006 Population of 850,000 persons
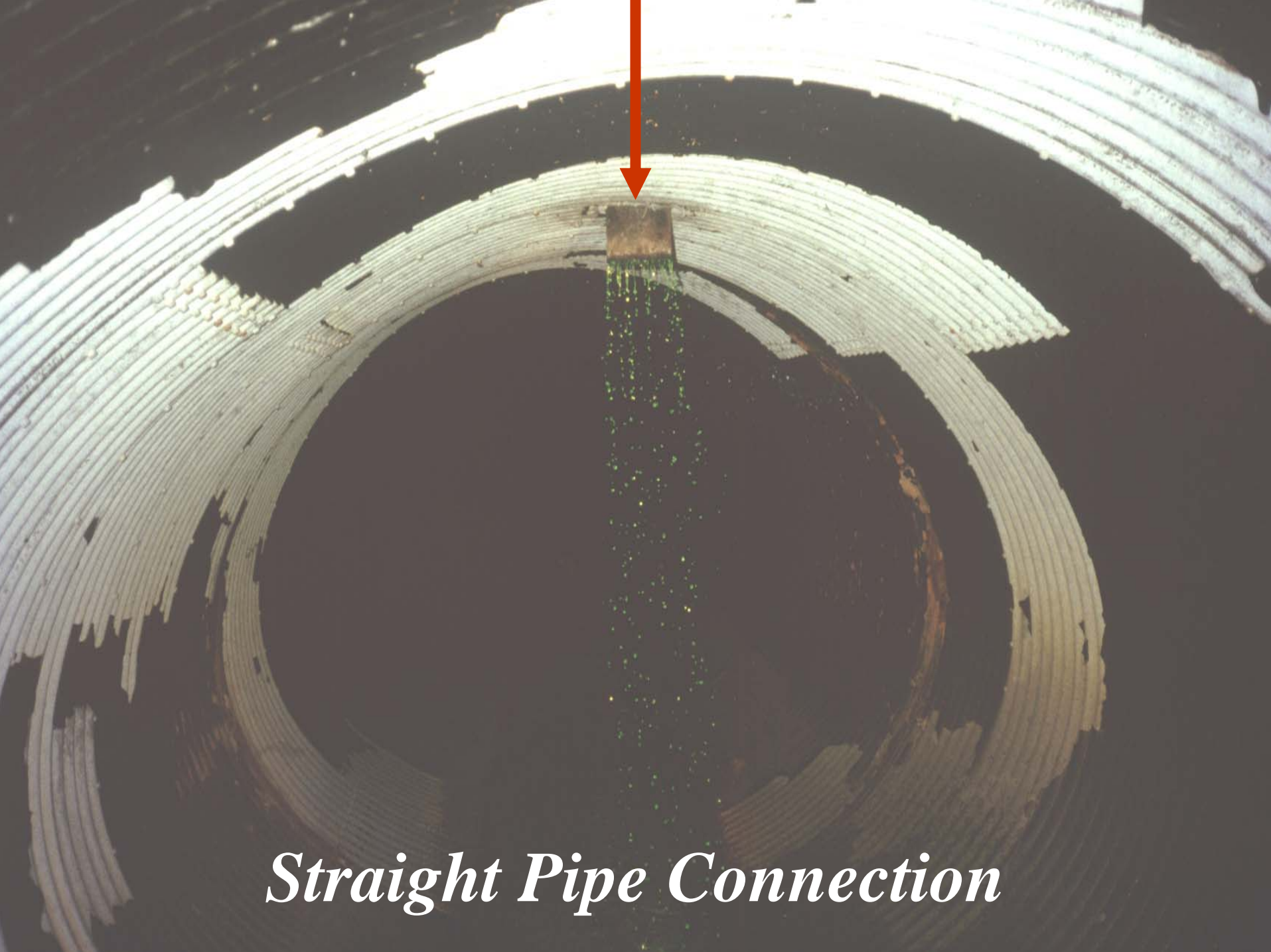
Straight Pipe Connection

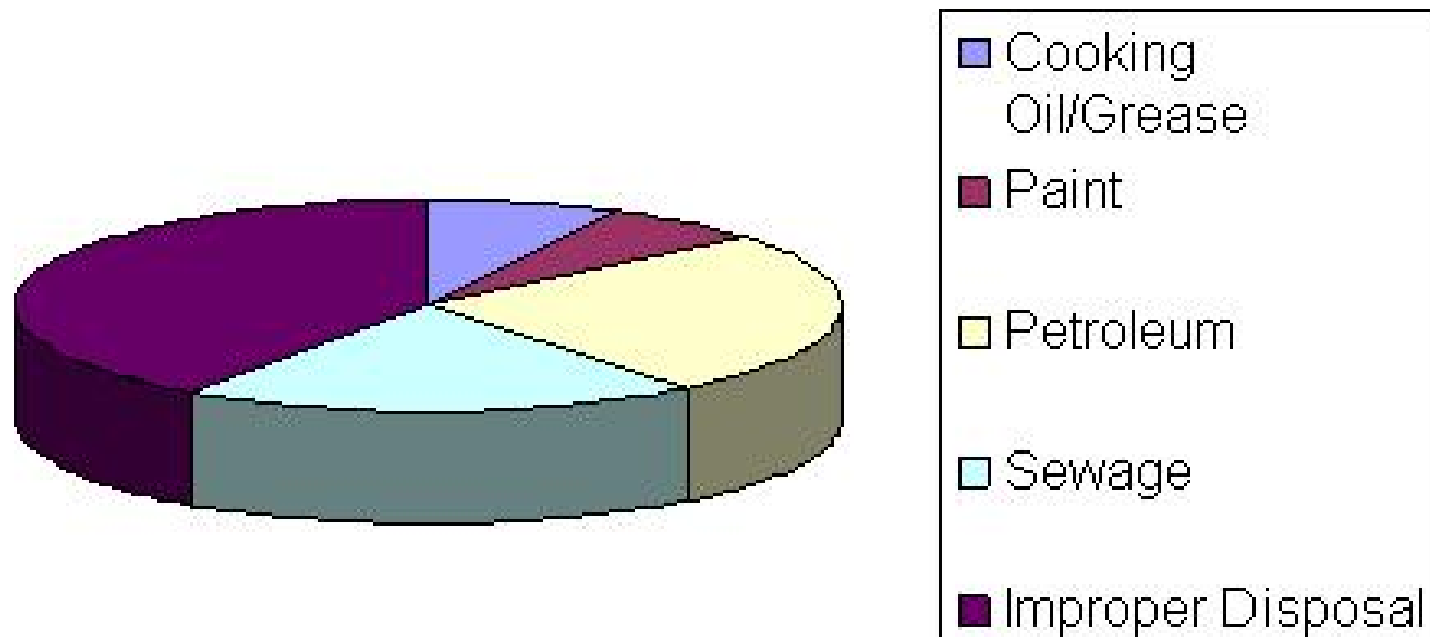# Carpet Cleaning Discharge

Receiving Stream

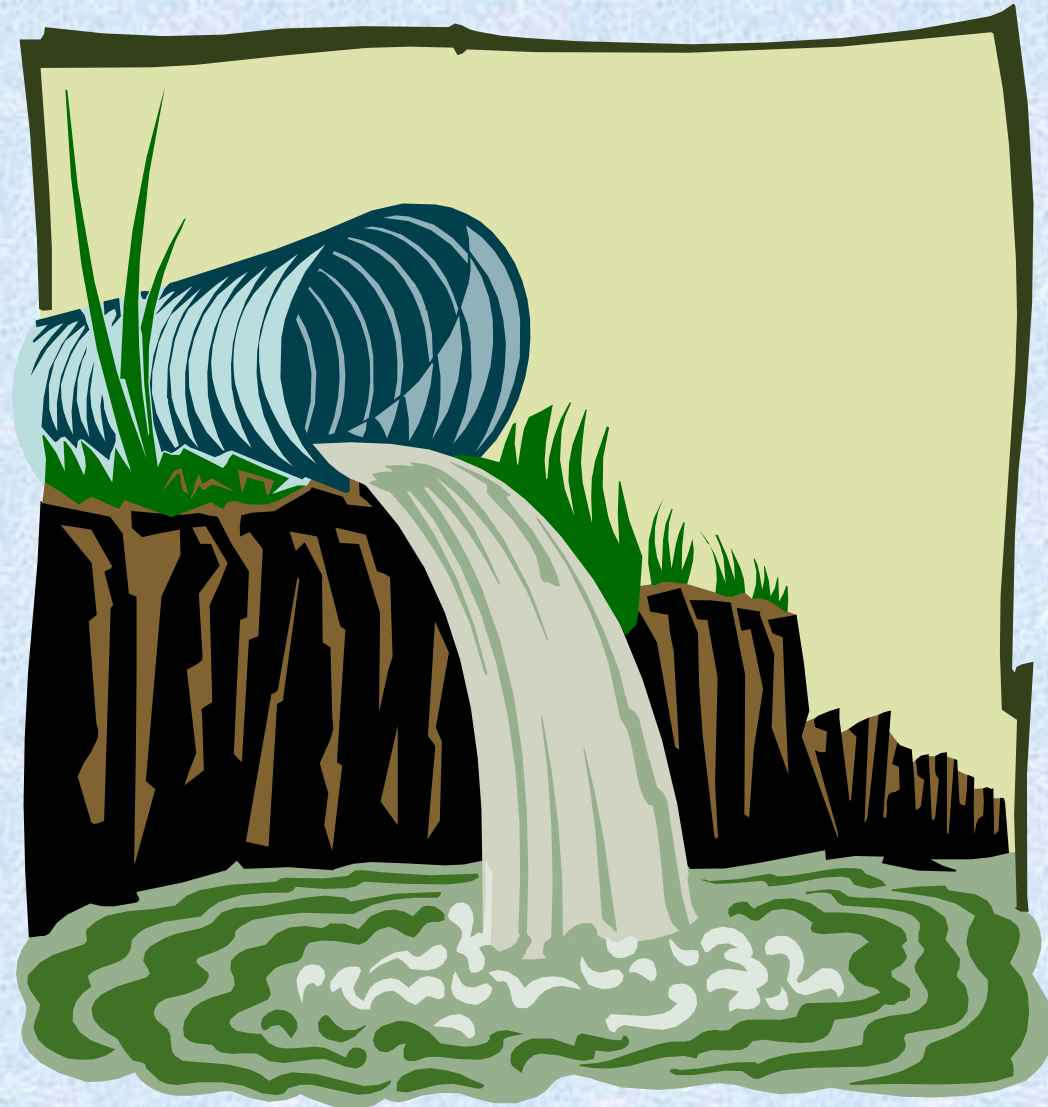*Paint Discharged To Stream*

Broken Sewer Line

City of Charlotte
Illicit Discharge Categories

Charlotte-Mecklenburg IDDE Detection Methods

Public Awareness

Stream Monitoring

Stream Walking

Industrial Inspections

Infrared Aerial Photos

City of Charlotte IDDE Public Education & Awareness

Advertisements (radio, television, newspaper)

Educational Seminars

Storm Drain Marking

Mailers/Door Hangers

Charlotte-Mecklenburg Stream Monitoring for IDDE Detection

- 23 Monthly Monitored Sites
- 3 Full-Time Staff Members
- $50,000 Annual Lab Costs
- Parameters include Bacteria, DO, pH, Conductivity

Charlotte-Mecklenburg Volunteer Adopt-A-Stream Program

Stream Walking

Charlotte-Mecklenburg Industrial Facilities Inspection Program for Illicit Discharge Detection
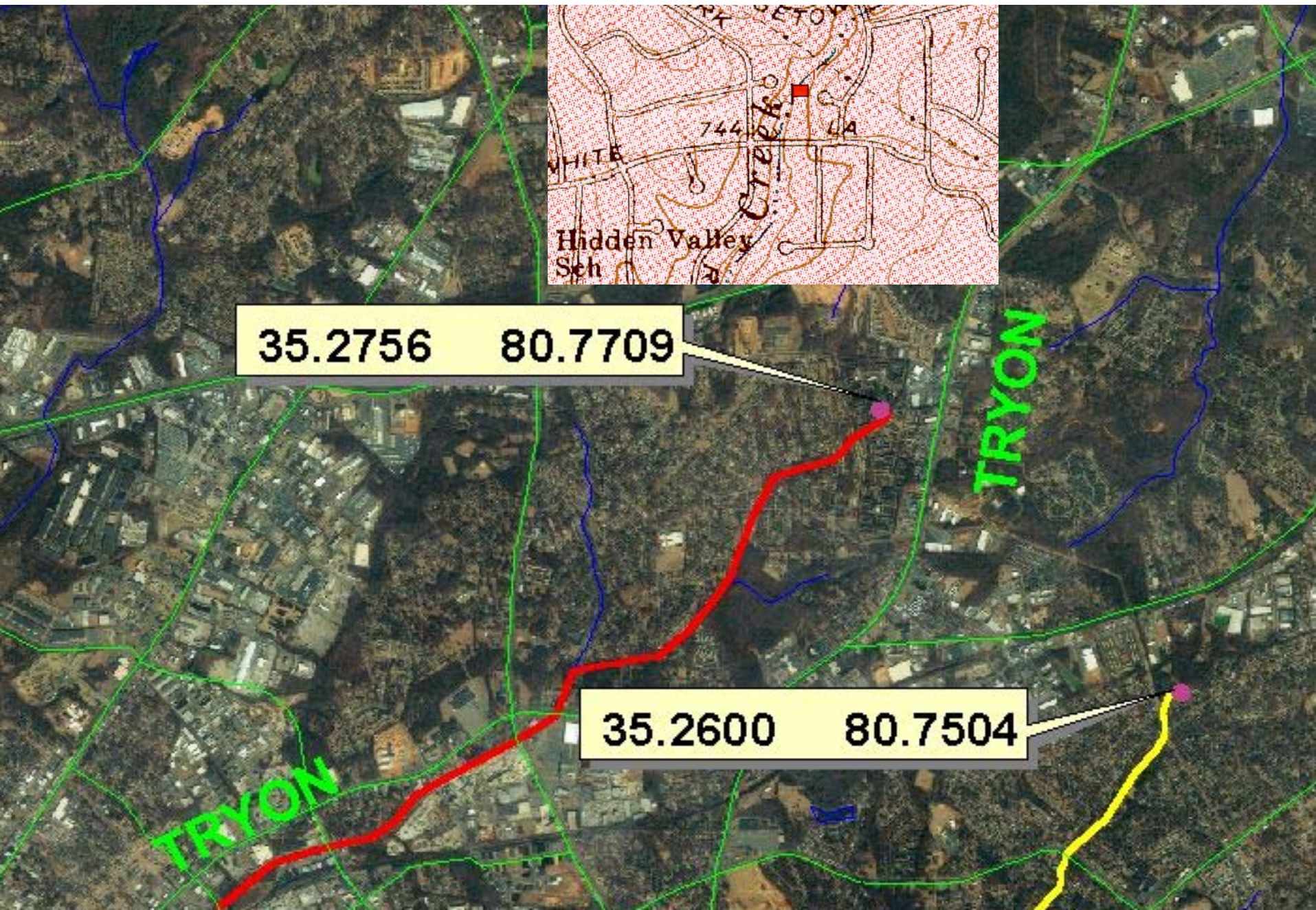
Aerial Infrared Photography

Total Cost = $5,000 to survey 27 miles of stream including the development of a final report complete with maps and pictures.

Contrast Between the Colder Stream Water and Illicit Discharge taken with Infrared Photography

FEB16/02,0223:33.370,-05,9/00,01928F
0111,3510.754N,08049.857W, 63KTS,252

GIS Overlay of the Infrared Aerial Photography

35.2756   80.7709

35.2600   80.7504

TRYON

TRYON

Infrared Photograph of Illicit Discharge from an Outfall

FEB16/02,0145:48.750.-05,9/01,01889F
0111,3510.376N,08050.799W, 58KTS,183

Infrared Aerial Photograph of a Leaking Sanitary Sewer Line

FEB16/02,0231:25.302,-05,9/00,02108F
0111,3509.897N,08050.227W, 48KTS,220

Leaking Sewer Collection Line

Charlotte-Mecklenburg IDDE Elimination Methods

Verbal Notice Of Violation

Written Notice Of Violation

Enforcement

Questions?